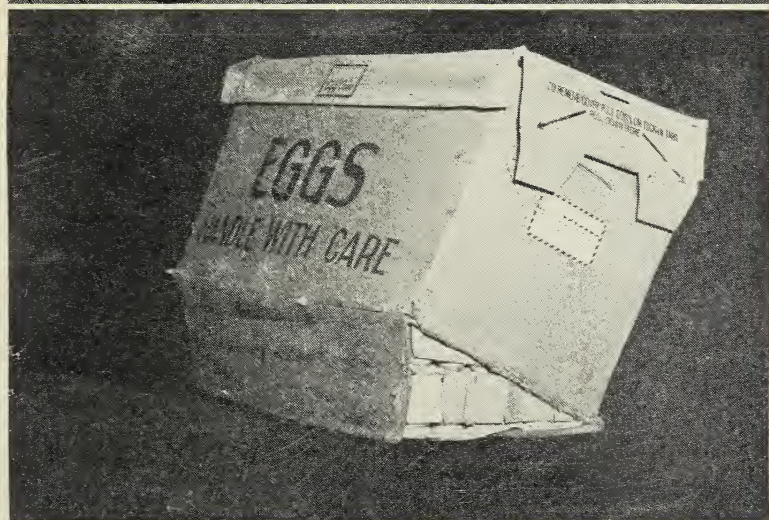
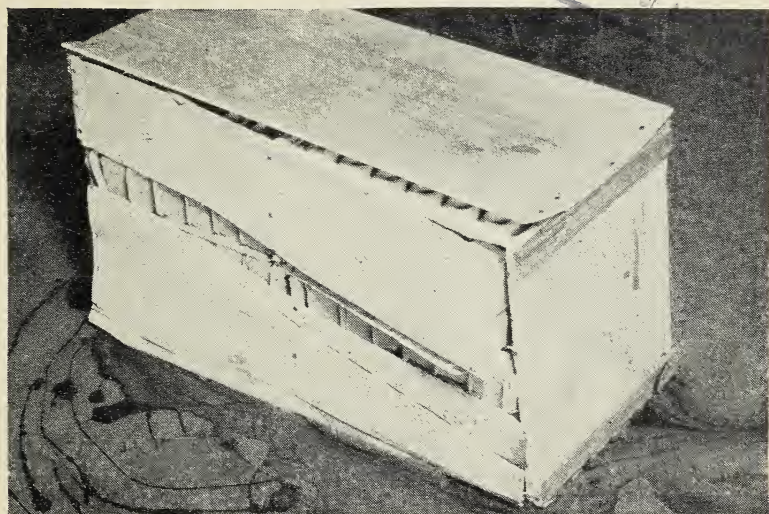
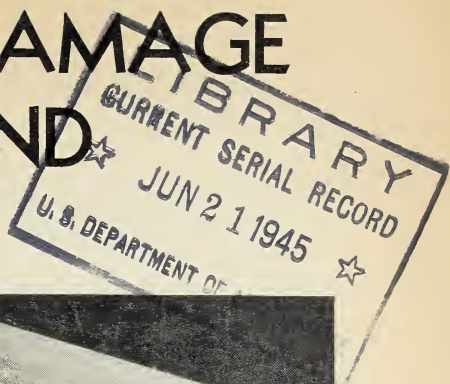


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REDUCING DAMAGE TO EGGS AND EGG CASES



Miscellaneous Publication No. 564

U. S. DEPARTMENT OF AGRICULTURE
War Food Administration

REDUCING DAMAGE to EGGS and EGG CASES

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Damage to eggs and egg cases during World War II has resulted in the loss of millions of dollars' worth of food and packaging materials. In 1944 alone, railroads paid claims of about \$650,000 for damage to shell eggs in transit. These claims represent only a very small part of the total damage.

Many factors are responsible for the alarming increase in losses during the war. All of these factors contribute to damage to a greater or lesser degree during normal times, the effect of some of them on damage is greater during wartime, and many of them responsible for losses are beyond the control of either the poultry industry or the railroads and truckers. Chief among the factors causing damage to eggs and cases are (in order of appearance and not of importance):

1. Insufficient and inexperienced help, as well as inadequate equipment and machinery for the poultry industry, the railroads, and truckers.
2. Use of improper containers (fig. 1).
3. Inadequate packaging materials (fig. 2).
4. Type, design, and dimensions of the case.
5. Careless assembly and handling of the cases.
6. Careless grading of eggs.
7. Position of the egg in the case.
8. Incomplete or improper closure of the case (fig. 3).
9. Use of poorly equipped and reconditioned cars.
10. Improper loading of cases in railroad cars and trucks (fig. 4).
11. Position of the case in a railroad car (fig. 5).
12. Position of a railroad car in a train.
13. Use of longer trains, with heavier loads per car and higher rates of speed, traveling on rails now in poor condition.
14. Excessive shocks in switching railroad cars, and impacts in transit (fig. 6).
15. Careless handling, unloading, and stacking of cases at destination (fig. 7).
16. Careless handling and improper methods of stacking cases in storage.
17. Storing eggs in containers not made to withstand storage conditions.

As a means of reducing such damage, a number of suggestions are offered, based on recommendations made by members of the poultry industry, rail-

road officials, shippers, warehousemen, manufacturers, and others. The practices herein suggested are subject to adjustment or change through governmental, railroad, or trucking regulations.

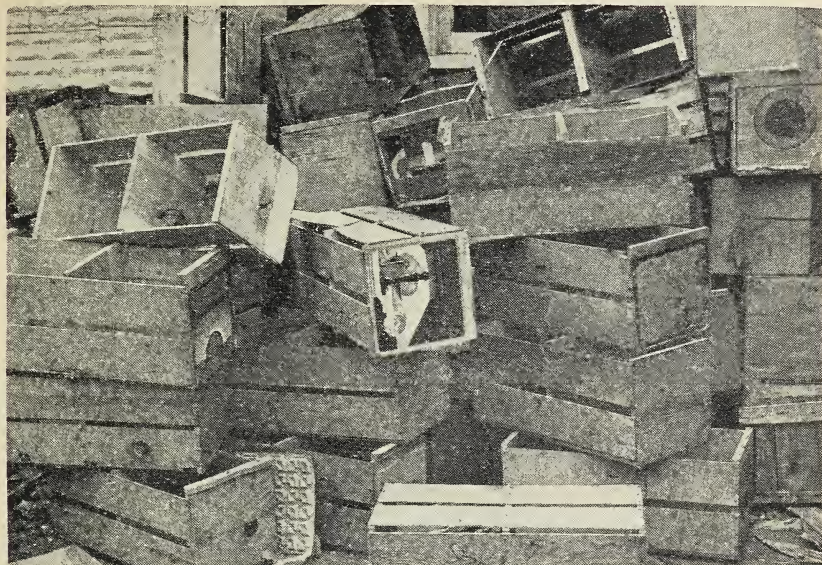


Figure 1.—Severe damage resulted from the use of orange crates and miscellaneous containers as egg carriers during the peak of the 1944 egg season.



Figure 2.—Cases made of some materials used during the war do not hold up satisfactorily.

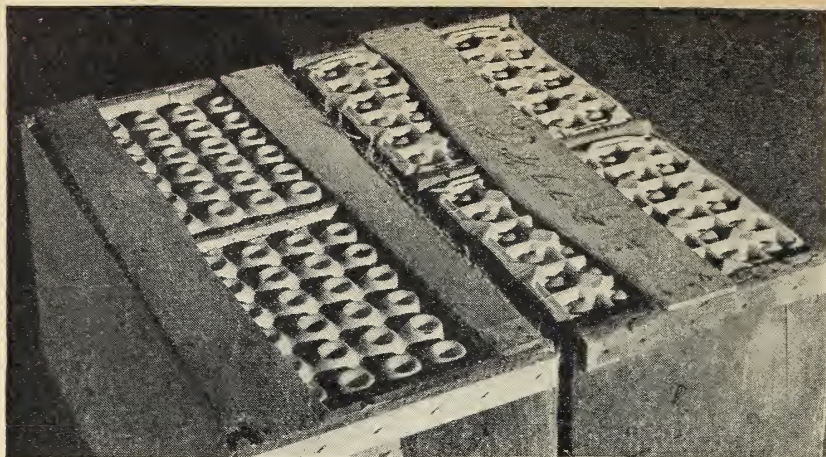


Figure 3.—Full covers on wooden cases are a "must." Inadequately covered cases expose contents to damage.

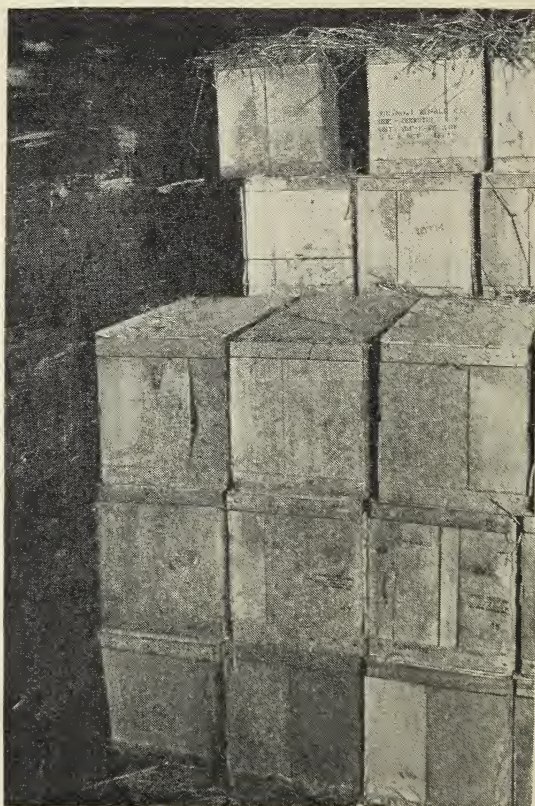


Figure 4.—Loose stacking of egg cases in railroad cars leads to damage.

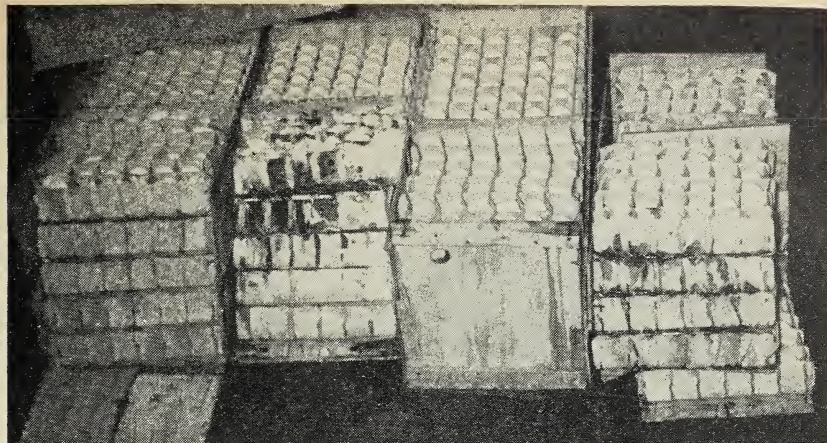


Figure 5.—These egg cases were taken from the bottom layer in the front end of a refrigerator car where the greatest damage frequently occurs.



Figure 6.—Improper loading plus excessive impacts en route resulted in severe damage to these cases.



Figure 7.—Improper stacking of cases at destination results in unnecessary damage. Fiber egg cases should never be placed under wooden cases. Badly damaged cases should be put on the top layer or laid aside.

PRODUCERS SHOULD—

1. Keep supplies of 3-inch paper tape and threepenny large-headed cement-coated nails on hand for use in repairing fiber and wooden egg cases.

2. Repair broken cases promptly.

3. Use second-hand cases to deliver eggs from producers to receivers, or to ship eggs short distances.

4. Store, in a relatively cool, dry atmosphere, cases not needed for immediate use.

5. Keep fiber and wooden egg cases separated.

6. Remove tops from wooden cases carefully to avoid splitting them.

7. Use only clean cases, flats, and fillers.

8. Grade eggs for uniformity in size.

9. Pack eggs with small end down. Pack large eggs, "cracks," and "checks" separately. Extra large eggs for shipment should be packed 18 eggs to the filler.

TRUCKERS AND HUCKSTERS SHOULD—

1. Not accept cases containing extra large eggs, cracks, or leakers from producers unless such cases are properly identified so that they may receive special care.
2. Repair broken cases promptly. Keep a supply of tape and nails on hand for this purpose.
3. Load cases on truck lengthwise to the truck (figs. 8 and 9).
4. Load fiber egg cases on top of the wooden cases.
5. Return cases promptly to the producers. Any breakdown in the flow of eggs results in the use of unsatisfactory containers, thereby causing damage and loss.

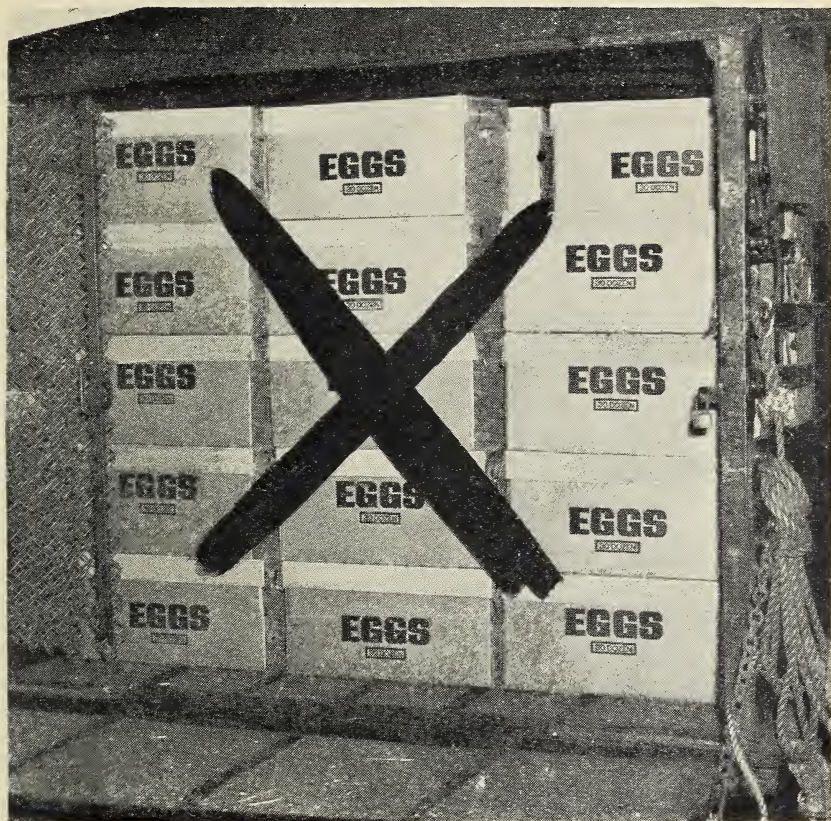


Figure 8.—Cases should not be loaded in a truck crosswise since their side-to-side resistance to pressure and shock is not as great as end-to-end resistance.

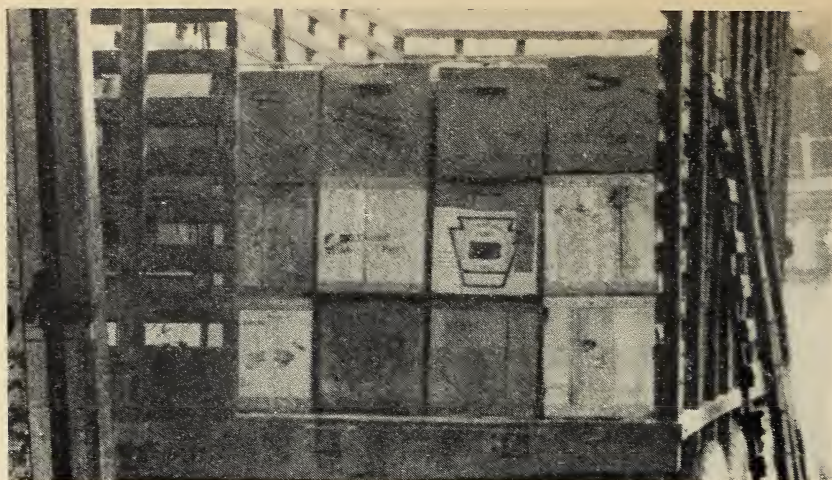


Figure 9.—Cases of eggs should be loaded lengthwise in a truck. Note that the fiber cases are correctly loaded on top of wooden cases.

PACKERS AND SHIPPERS SHOULD—

1. Return all empty, used cases promptly.
2. Destroy all broken, moldy, or badly damaged egg cases (fig. 10).
3. Be sure that all assembled wooden cases are properly squared and evened.
4. Be careful to see that all stitches in fiber egg cases are placed properly and in accordance with classification requirements.
5. Use only new cases, fillers, and flats for shipments by rail, or on long hauls by truck (fig. 11).
6. Use 38-ounce fillers instead of 35-ounce fillers, in wooden cases, whenever possible.

Studies show that as the weight per set of fillers increases, their crushing strength and the strength of the tips also increase. (*See table 1.*)

a. Use combined fillers and flats if recurring damage is found, or if other methods of reducing damage have failed. Preliminary tests indicate that eggs packed in combined fillers and flats, or their equivalent, show less damage in transit than do those in other types of packaging (fig. 12).

b. Place 30 two by six cushioned egg cartons firmly in the case to help to reduce damage in transit. The layers of cartons in the case should be alternated, the bottom layer placed with cartons lengthwise to the case, the next layer with the cartons extending across the width of the case, and so on up to top layer (fig. 13).

Place one flat on the bottom of each compartment and one flat on the top of each compartment in the egg case (fig. 14). Eggs packed in this

way have the advantage of being in cartons ready for retail sales. Thus, the grading of the eggs is confined to one process, and labor and time are saved. The use of this carton pack, however, requires more labor and time at the shipping point.

7. Grade, especially for size, all eggs that are to be shipped (fig. 15). Pack extra large eggs separately. Cracks, checks, and leakers should not be shipped. Careless grading increases egg losses in transit. (See table 2.)

8. Add as many extra flats to the top of each compartment in an egg case as necessary to take up any slack space between the top layer of eggs and the cover of the case.

Recent Army tests indicate that an addition of one extra inverted flat on top of each compartment in egg cases of standard size, holding eggs weighing approximately 46 to 49 pounds net per case, reduces damage (fig. 16). For higher cases, more extra flats might be necessary. For eggs, in standard cases, weighing more than 49 pounds net per case, no extra flats should be needed.

9. Tape all raw edges on fiber egg cases with 3-inch paper tape to close them securely (fig. 17). Transportation tests indicate that cases taped this way carry eggs in transit more safely and with less damage to the case (figs. 18 and 19).

10. Load cases into refrigerator car properly.

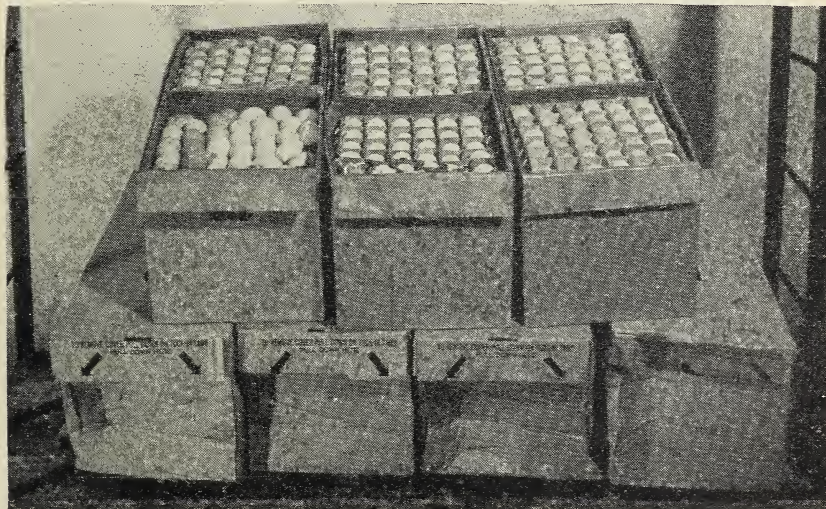


Figure 10.—Cases such as these should not be re-used. Breakage and leakage cause a rapid deterioration in cases, fillers, and flats.

a. **Inspection of cars before loading.**—Run a board over the contact surface of the refrigerator car to ascertain the presence of protruding nails. Remove any that may be found. Repair or remove wood splinters and broken boards.

b. **Plan of loading.**—Make plan of loading before cases are stowed in the car. In making a plan, consider the Office of Defense Transportation special direction ODT 18A Amendment 2, Item No. 46, also the size of the car, the size of the cases, the type of cases, and the number of cases to be loaded.

The Office of Defense Transportation Loading Order, Item No. 46, of October 27, 1944, reads as follows: "Eggs, Shell: In containers, fiberboard and wooden, shall be loaded lengthwise with cases covering the full floor area and shall be loaded not less than five tiers high."

Refrigerator cars used to ship eggs are for the most part of such size as to permit the stowing of wooden and fiber egg cases in different proportions as shown in table 3.

The number of cases stowed the length and width of the car will depend on the size of the cases as well as on the dimensions of the car.

The loading of fiber and wooden egg cases in the same car is not recommended. (The loading of different sizes of egg cases and of other products with eggs in the same car should also be avoided.)



Figure 11.—Only new cases containing new fillers and flats should be used to ship eggs by rail or long distances by truck.

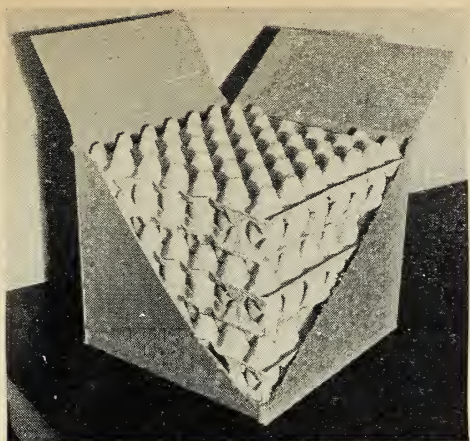


Figure 12.—Combined fillers and flats hold each egg snugly in place and act as a buffer against shock.

Example of a Loading Plan

A plan of loading may be worked out on paper, or simply in the head of an experienced railroad car loader.

Given Conditions

- (1) 640 X-fiber egg cases, outside dimensions $24\frac{1}{2}'' \times 12'' \times 12\frac{7}{8}''$.
- (2) One refrigerator car, inside dimensions $33'2\frac{3}{4}'' \times 8'2\frac{5}{8}''$.
- (3) Straw for buffer.

NOTE.—In subsequent examples of loading, the fiber egg cases will be of the same dimensions as those of the X cases. Likewise, all cars used as illustrations in these examples will be of the same dimensions as the one listed above.

Procedure

Total length of car $33'2\frac{3}{4}''$ —16 cases in each horizontal row.

Length of each case $24\frac{1}{2}''$.

Length of 16 cases $24\frac{1}{2}''$ long = $392''$ or $32'8''$.

Total length of each car $33'2\frac{3}{4}''$ minus $32'8''$ (total length required for each row of 16 cases) = $6\frac{3}{4}''$ buffer space.

Total width of the car $8'2\frac{5}{8}''$ —8 cases across the width of the car stowed lengthwise.

Width of each case $12''$.

16 cases long by 8 cases wide = 128 cases in one layer or tier.

128 cases (in one layer) multiplied by 5 (the minimum number of layers according to ODT order) = 640 cases.

640 X cases to load—640 cases in 5 complete layers in this car.

c. Deciding on a method of loading.—When egg cases, all fiber or all wooden of the same dimensions, are to be stowed in a refrigerator car, they may be loaded as illustrated in figure 20. Although the practice is not

recommended, when fiber and wooden egg cases must be stowed together in the same car, loading may be done in one of the following ways:

Method 1.—To load 320 fiber egg cases and 300 standard wooden egg cases in the same car, put the fiber cases in one-half of the car divided lengthwise and the wooden cases in the other half of the car, as illustrated in figure 21.

Method 2.—To load 360 standard wooden cases and 256 fiber cases in the same car, put three layers of wooden cases on the bottom and two layers of fiber cases on top as illustrated in figure 22.

Method 3.—To load 328 standard wooden cases and 288 fiber cases in the same car, put the fiber cases on top of the wooden cases as shown in figure 23.

Loading narrow cars.—When a car narrower than one generally used is to be loaded with one kind of case, stow the cases lengthwise in the car and solidly across it, filling up the extra space with straw. Stagger the row so that the straw is on the left side of the first layer of cases, on the right side of the second layer, and so on up, as shown in figure 24.

d. Loading the refrigerator car.—The first consideration in loading a car is to make sure that all cases are stowed tightly. Place a row of cases lengthwise against one side of the car as close together as possible, starting from each end and building toward the center. This will serve as a guide row, as does the row of cases shown in figure 25.

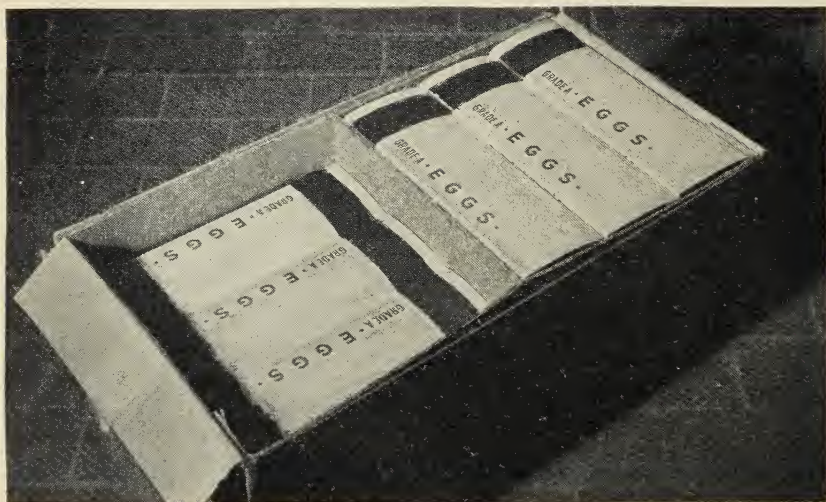


Figure 13.—Cartoned eggs usually make a firm pack in cases.

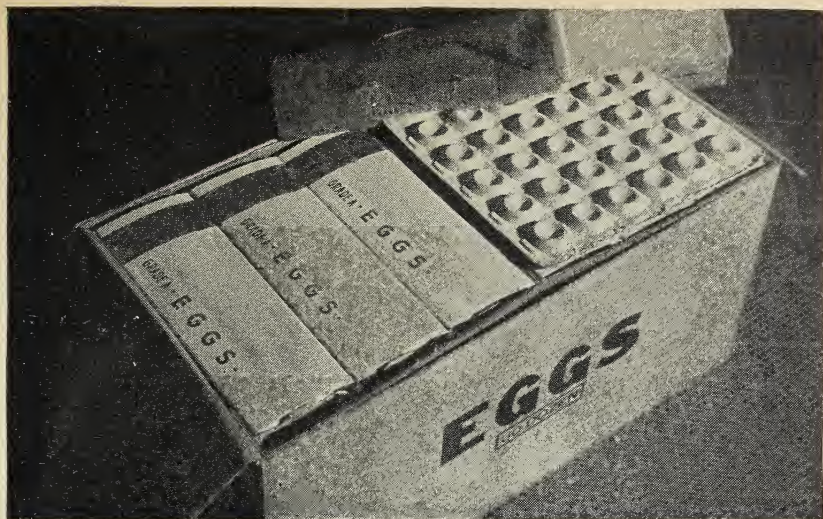


Figure 14.—One flat on top and one flat on the bottom of each compartment of the carton pack help to reduce movement in the case.

Starting from the ends, build one complete stack at a time, working toward the center of the car and using the guide row to direct the loading.

To load wooden cases tightly, use a pressure board and tightener on every row, stack, and layer in the car, pushing one case against another. The pressure board and tightener are not desirable for use on fiber cases (fig. 26).

PRESSURE BOARD AND TIGHTENER.—To make a pressure board, fasten a 2' x 4' x 8' board edgewise to the center of a 1' x 1½' x 12½' piece. The tightener is made by fastening a 15-inch metal blade to a 2' x 4' x 5' board so that the metal extends 1½' below the base of the board. Edges of the upper part of the tightener should be strengthened and smoothed.

As you build in the last stack of cases in the center of the car, force straw tightly between cases (assuming that straw is to be used as the buffer) (figs. 27 and 28).

Packing for export

1. Use new cases, flats, and fillers.
2. Grade eggs for uniformity in size particularly and eliminate any eggs extending above filler.
3. Use one extra inverted flat on top of each compartment in each egg case to take up any slack space in the case. (For eggs weighing between 46 and 49 pounds net per case, packed in standard-sized case.)
4. Wire securely around each end and center of case (fig. 29).

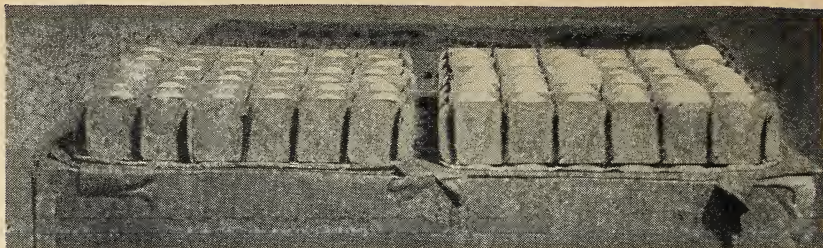


Figure 15.—Only one or two extra large eggs in a flat frequently causes egg breakage. The contents from the broken eggs will be absorbed by the fillers and flats, thus prohibiting their re-use.

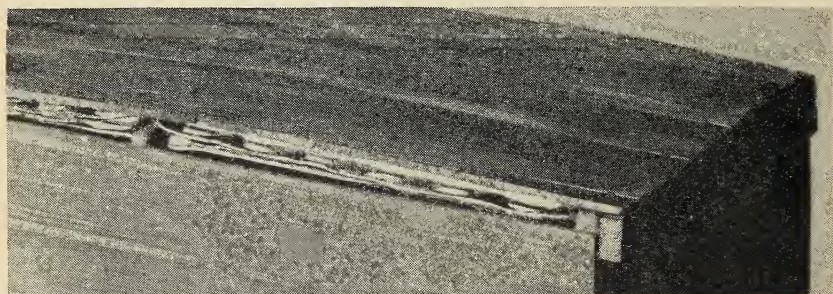


Figure 16.—The use of an extra inverted flat on the top of each compartment in a case that contains eggs weighing from 36 to 49 pounds net per case has helped to reduce damage to the eggs and hence to the fillers, flats, and containers.

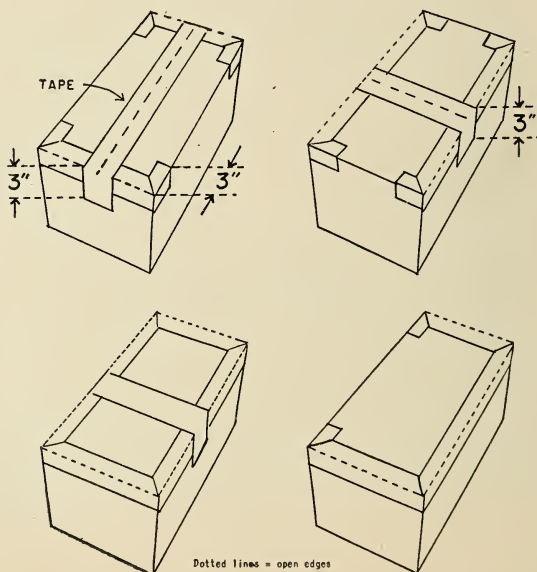


Figure 17.—Proposed methods of taping four egg cases that have different types of closures.

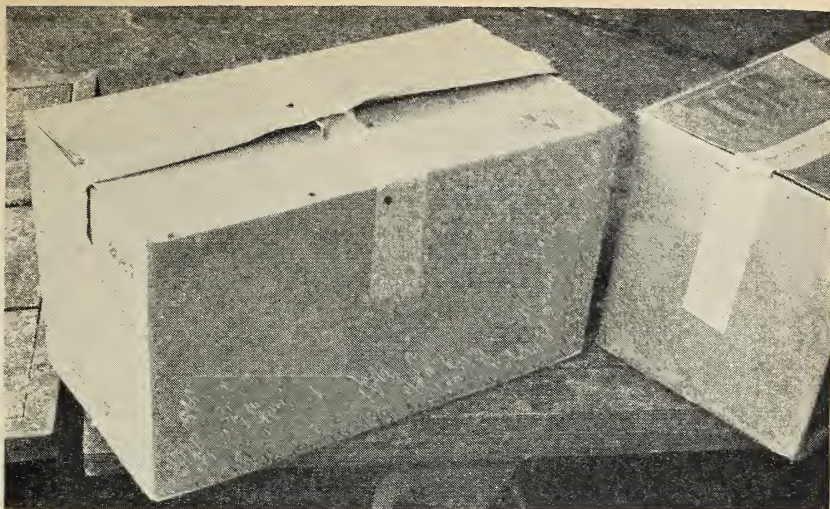


Figure 18.—When a smooth and complete contact between the case and the gummed surface on the tape is not made, the tape will not hold. Damage to the cover may result.

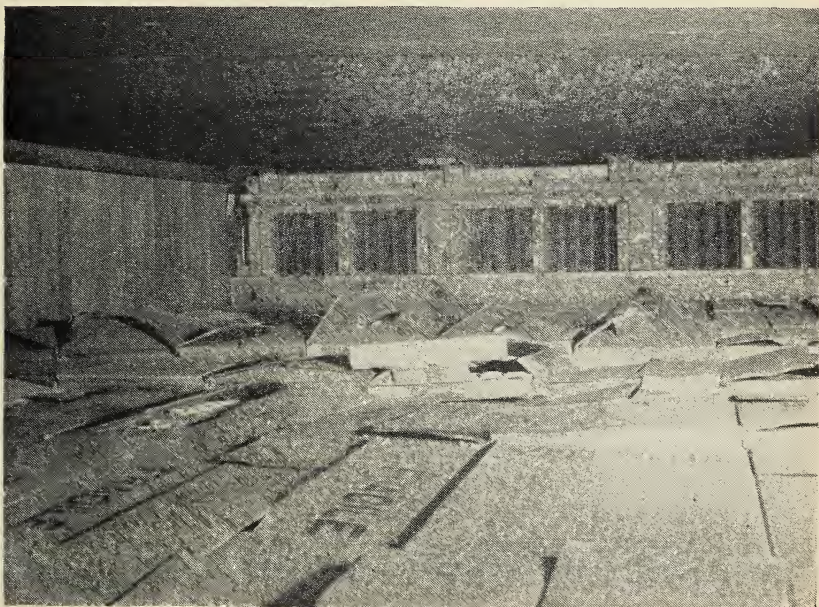


Figure 19.—Taping would have aided materially in preventing broken covers and loose flaps in this car.

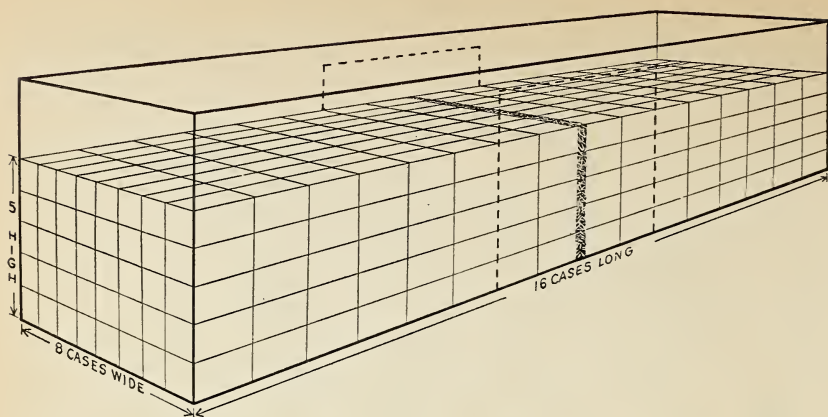


Figure 20.—Six hundred and forty fiber egg cases loaded properly.

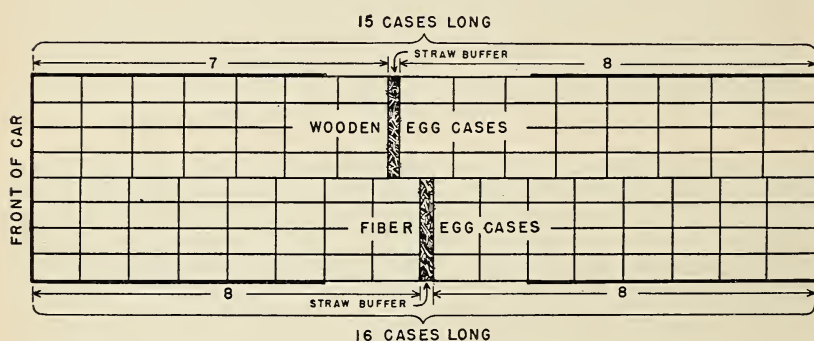


Figure 21.—Top view showing a good method of loading 320 fiber cases and 300 wooden cases in the same car.

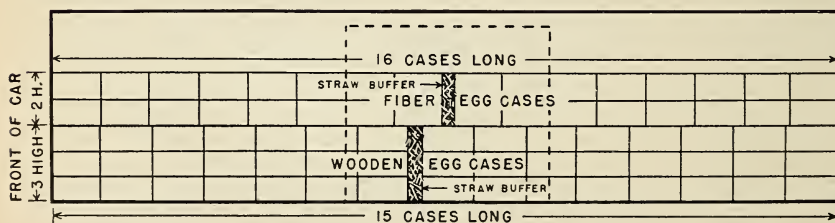


Figure 22.—Side view showing the loading of 360 wooden cases and 256 fiber cases in the same car.

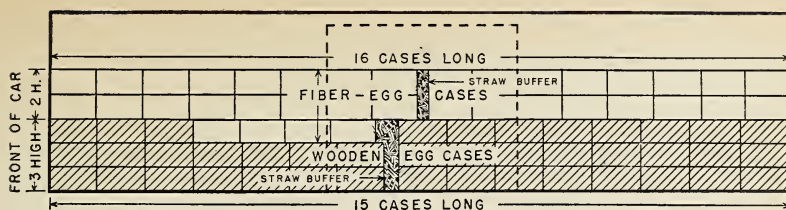


Figure 23.—Side view showing desirable method of loading 328 wooden cases and 288 fiber cases in the same car.

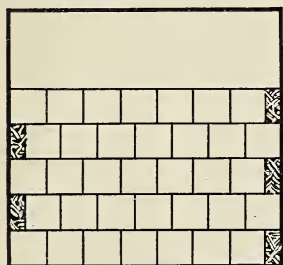


Figure 24.—End view showing a good method of loading egg cases in a narrow car.

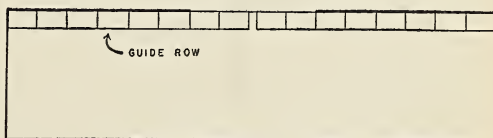


Figure 25.—A guide row should always be placed in a car to help determine the most desirable loading method and procedure.

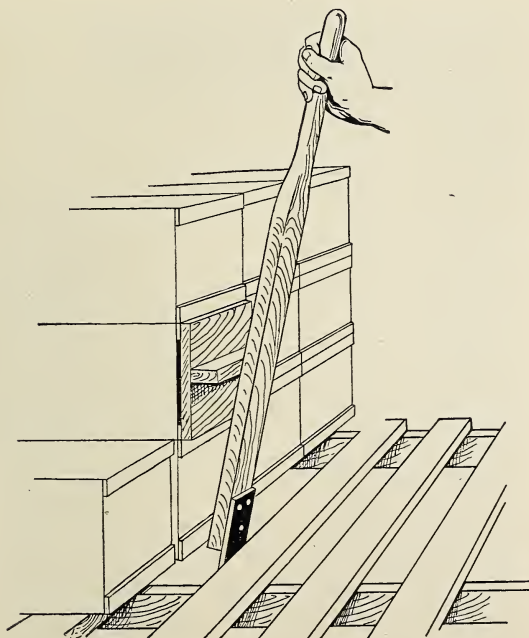


Figure 26.—The proper use of a pressure board and tightener.



Figure 27.—Lack of planning made adequate buffering in loading this car impossible. Damage usually results in such instances.

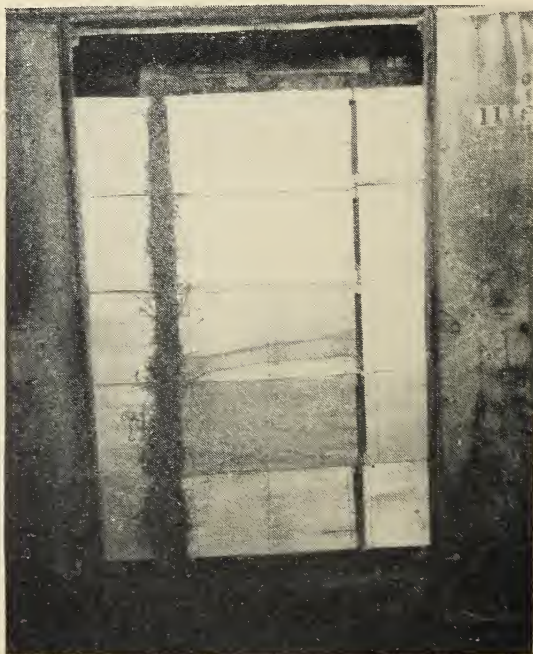


Figure 28.—Good planning, loading, and buffering carried this shipment to its destination satisfactorily. (Top view.)

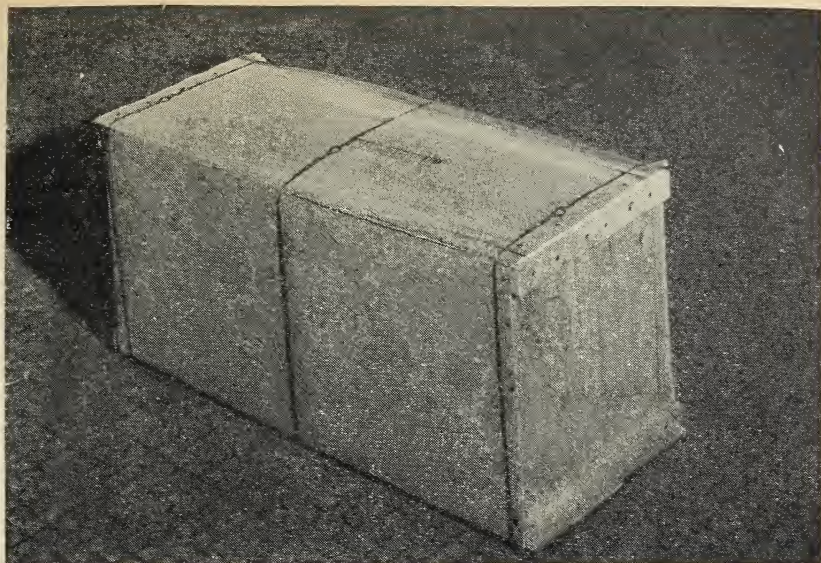


Figure 29.—Bound-wire strapping on an export case.

COLD STORAGE WAREHOUSEMEN SHOULD—

1. Not use fiber egg cases made of non-moisture-resistant board for storing eggs, except for short periods (fig. 30).
2. Accept only sound cases in good condition.
3. Store eggs separately from other products.
4. Try to meet the requirements of a good cold storage room, which are:
 - a. Sanitary condition (fig. 31).
 - b. Relative humidity of 85 percent. Opinions and practice vary somewhat, but it is generally recognized that 85 percent is most desirable, with the upper range definitely not above 87 and the lower range not below 80 percent.
 - c. Constant temperature of 30° F. (Fans help to maintain even temperature and humidity in storage room.)
5. When the storing of eggs in fiber cases is unavoidable, the following practices will help to reduce loss:
 - a. Fiber cases should have either ventilation or open handholes.
 - b. Fiber cases should never be stacked under wooden egg cases (fig. 32).
 - c. Fiber cases should never be stacked more than six cases high.
 - d. Wooden strips 2" x 2" or 2" x 4" should be placed on the floor to

support the middle and ends, or sides of each fiber case in the bottom layer of the stack (fig. 33).

e. Edges of the cases in the stacks should be squared so that the edges of one case fall directly over the edges of center partitions of another case (fig. 34).

Desirable methods of stacking fiber egg cases

Two methods of stacking fiber cases are recommended. These are the "stair-step" method, as shown in figure 35, and the "two by four interlocking" method, as shown in figure 36.

BREAKING-PLANT OPERATORS SHOULD—

Use lifters, to reduce damage to the flats and fillers, as well as to the eggs, in all breaking plants that grade eggs mechanically and in plants that oil-process eggs (fig. 37).

MANUFACTURERS OF EGG CASES SHOULD—

Take steps to assure the production of cases that meet the requirements as shown in the railroad Classification Rulings. All fiber egg cases should have hand or ventilation holes, or both.

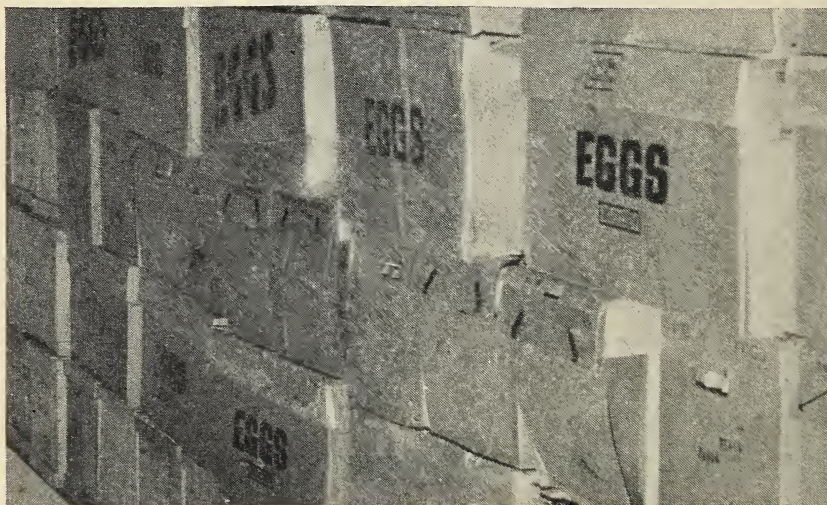


Figure 30.—Non-moisture-resistant fiber egg cases do not hold up in storage.

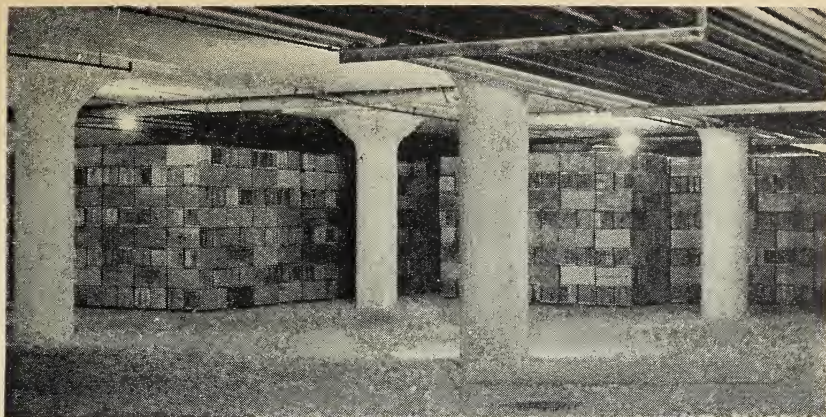


Figure 31.—A well-managed, sanitary, commercial, cold-storage room.

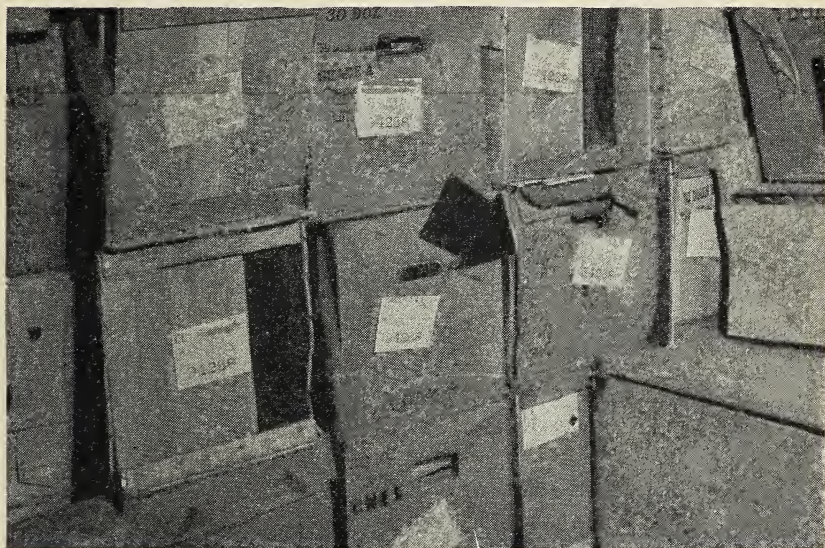


Figure 32.—The stacking of wooden egg cases over fiber cases is a bad practice and often results in damage to the fiber case.

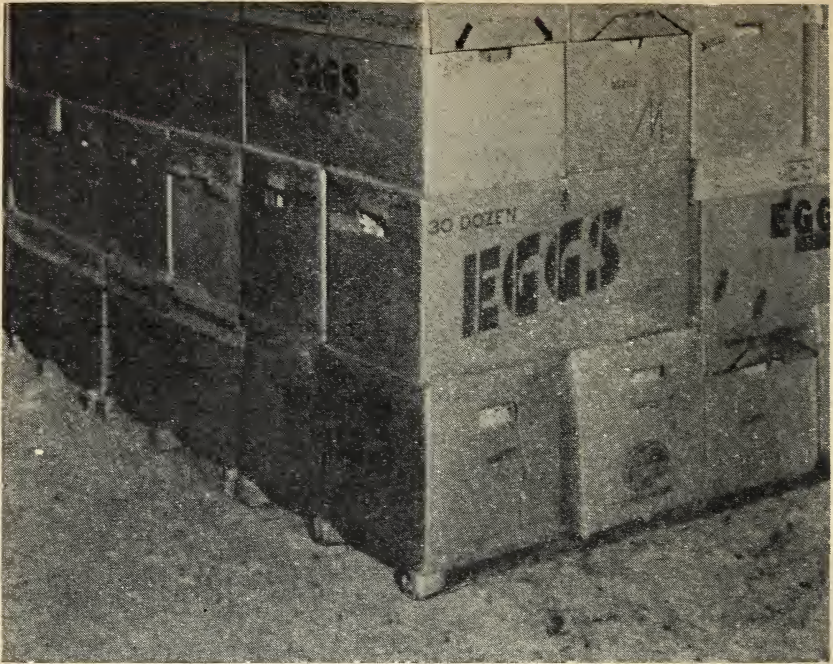


Figure 33.—Three wooden strips should be used on the floor to support the middle, ends, and sides of each egg case in the bottom layer of the stack.

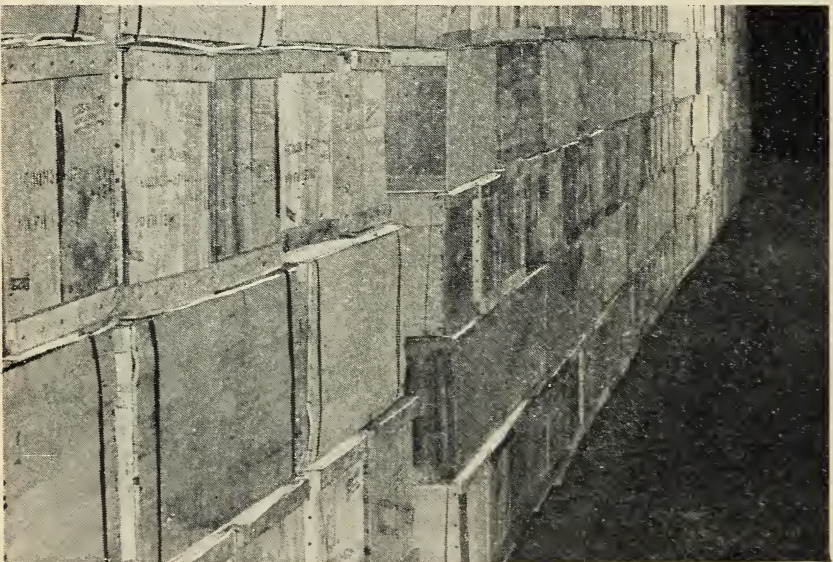


Figure 34.—Some of the cases in the lower layers of these stacks are likely to be damaged because the cases in the upper tiers have not been placed squarely over those in the lower tiers.

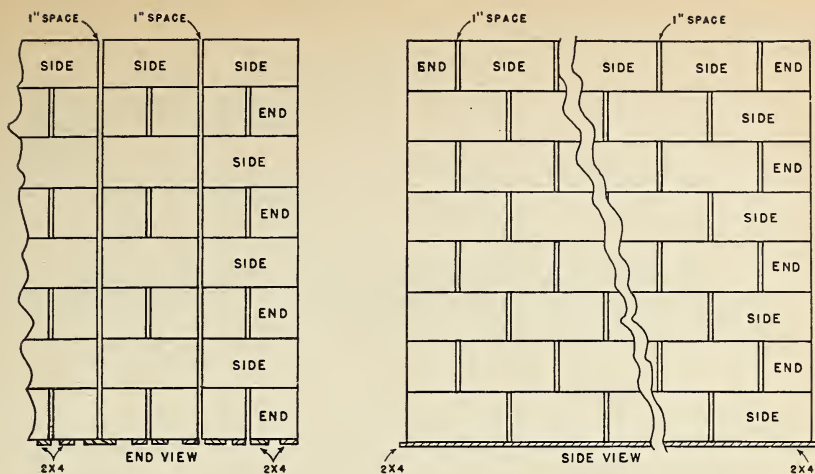


Figure 35.—End and side views of fiber egg cases stacked by the "stair-step" method.

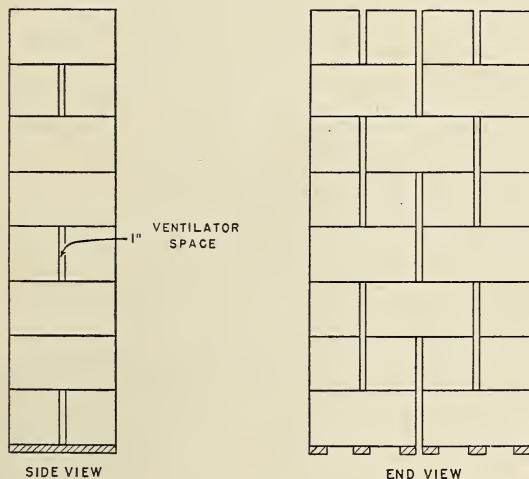


Figure 36.—Side and end views of fiber egg cases stacked in a cold-storage warehouse according to the recommended "two by four interlocking" method.

Figure 37.—The use of mechanical lifters helps to reduce damage to eggs, fillers, and flats in breaking plants and in plants that oil-process eggs.

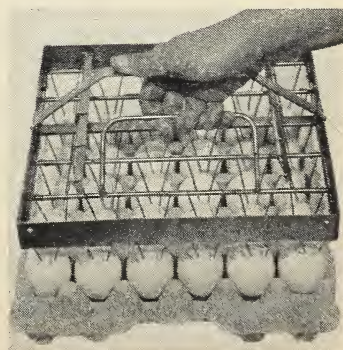


TABLE 1.—Crushing strength of fillers¹

Trade name	Weights per set		Crushing strength	Strength of tips
	Pounds	Ounces	Pounds	Pounds
No. 1.....	3	12	685	57
3 pounds.....	3	6	595	42
Medium.....	3	3	471	38
No. 2.....	2	8	325	36

¹ Crushing strength determined by compression machines.

Data from U. S. Dept. Agr. Bul. 664, p. 17. 1918.

TABLE 2.—Damage in transit

Condition at packing house	Individual eggs	Eggs damaged in transit	
	Number	Number	Percent
<i>Container</i>			
Well-fitting.....	33,626	639	1.90
Long.....	323	12	3.71
Short.....	1,170	11	.94
Narrow.....	467	7	1.49
<i>Eggs</i>			
Sound shells.....	76,386	1,162	1.77
Cracks.....	4,368	125	2.88
Dents.....	972	22	2.37

Data from U. S. Dept. Agr. Bul. 664, pp. 13, 15. 1918.

TABLE 3.—Number of wooden and fiber egg cases that are accommodated by refrigerator cars generally used

Total	By length	By width	By height
	Wooden egg cases		
600.....	15	8	5
560.....	14	8	5
520.....	13	8	5
	Fiber egg cases		
640.....	16	8	5
600.....	15	8	5
520.....	13	8	5